



Association between HIV Clinical Stage and The Incidence of Opportunistic Infections among HIV/AIDS Patients at Banten Regional Hospital in 2020-2024

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ABSTRACT

Introduction: Untreated HIV conditions can progress to AIDS, which is the terminal phase of HIV infection, making the body more susceptible to other infections called opportunistic infections. Opportunistic infections are generally not dangerous for healthy people but can be fatal if they affect people with immunosuppression, such as HIV/AIDS patients.

Objective: This study aims to determine the relationship between HIV clinical stage and the incidence of opportunistic infections among HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Methods: This study is retrospective with a cross-sectional design. The sampling technique used was consecutive sampling, and the sample size calculation used the two-proportion comparison formula. The research data were analyzed univariate and bivariate using SPSS 26.0 Program. The research hypothesis was tested using the Chi-square statistical test and the Mantel-Haenszel Common Odds Ratio Estimate.

Results: The respondents in this study were 242 HIV/AIDS patients. The results of the analysis showed that the prevalence of HIV/AIDS at Banten Regional Hospital in 2020-2024 was 0.06%, with the highest proportion being stage I (50.83%), stage III (26.45%), stage IV (14.88%), and stage II (7.85%). The prevalence of opportunistic infections was 45.45%. Of the 110 patients identified as having opportunistic infections, 141 infections were obtained. Some patients had one type of opportunistic infection (81.82%), two types of opportunistic infections (11.82%), and $\geq$ three types of opportunistic infections (6.36%). The proportion of opportunistic infections based on etiology was dominated by bacterial infections (73.76%), parasitic infections (13.48%), fungal infections (6.38%), and viral infections (6.38%). The most common opportunistic infections suffered by HIV/AIDS patients at Banten Regional Hospital were tuberculosis (44.68%) and toxoplasmosis (9.93%).

Conclusions: Based on bivariate analysis, there was a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections among HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Introduction

Human immunodeficiency virus or better known as HIV is a type of virus that

damages the human immune system, especially CD4⁺ T cells which are responsible for fighting various types of

infections. HIV conditions that are not managed properly can progress to Acquired Immunodeficiency Syndrome (AIDS) which is the terminal phase of HIV infection so that the body becomes more susceptible to various types of diseases and other infections. This definition is in line with the Indonesian Minister of Health Regulation Number 23 of 2022 concerning the Management of HIV, AIDS, and Sexually Transmitted Infections (STIs), namely HIV is a virus that damages a person's immune system and has the potential to cause AIDS.

Referring to data published by UNAIDS (2024) regarding the current global HIV/AIDS situation, it is known that in 2019, 1.7 million people were detected with new cases of HIV infection. Then, at the end of 2020, it was reported that 12 million people with HIV (PLHIV) were considered to be at high risk of dying from AIDS if they did not immediately receive antiretroviral therapy (ARV). Although effective treatment is currently available, in 2019, it was reported that more than 700,000 people with HIV/AIDS (PLWHA) died.

Indonesia has adopted the "Triple 95s" strategy, the 95-95-95 target in 2030 to prevent and control HIV. For the first 95, 95% of PLHIV are expected to know their status; then the second 95 is that 95% of PLHIV are undergoing antiretroviral (ARV) therapy, and the third 95 is that 95% of PLHIV undergoing ARV therapy are

expected to have experienced viral suppression. However, until December 2022, Indonesia was reported to have not been able to achieve this target because the first target, namely 95% of PLHIV can know their status, has only been achieved by 81%, which means that there are still some PLHIV who do not know their status as HIV/AIDS sufferers. Then, for the second 95%, only 41% have been achieved, which means that only half of PLHIV are receiving ARV therapy. As for the last 95%, only 19% have been achieved, meaning that only a tiny portion of PLHIV on ARV therapy has suppressed their viruses.

During the treatment process, it was found that only 51% of PLWHA survived ARV treatment, then 54% failed to follow up on ARV treatment, and 6% stopped ARV treatment. The other 40% died. Although the incidence of HIV has decreased in 2020, deaths due to HIV/AIDS have been reported to be increasing (Indonesian Ministry of Health, 2022). In the study by Laksemi et al. (2020), it was stated that the leading cause of disease severity and death due to HIV/AIDS in the world is due to opportunistic infections.

Opportunistic infections can be defined as diseases caused by viruses, parasites, bacteria, or fungi that affect a person with a weak immune system. These infections are generally not dangerous for healthy people with robust immune systems. However,

they can be very fatal and dangerous for people who are immunosuppressed or have weakened immune systems, such as those with HIV/AIDS. An increased risk of opportunistic infections in PLWHA can occur if patients do not undergo ARV treatment and antimicrobial prophylaxis. The emergence of opportunistic infections in PLWHA generally begins in the final or terminal stages. Most of these infections are severe and often cause death in infected individuals. However, research on opportunistic infections is still relatively rare, so researchers want to examine the incidence of opportunistic infections in PLWHA further (Putri et al., 2024).

Several factors, such as malnutrition, can influence the incidence of opportunistic infections in PLWHA, CD4+ T cell count, type of transmission risk factors for transmission, age, and gender. Opportunistic infections can differ from region to region depending on the country's geographic location. In the HIV case report by WHO (2023), it is known that the highest opportunistic infection in Brazil is tuberculosis (40%), in Mexico it is Cytomegalovirus (65-69%), and in America and Thailand it is *Pneumocystis carinii* pneumonia (64% and 26%) (Putri et al., 2024). In Indonesia, the incidence of opportunistic infections in PLWHA is reported to be quite diverse but is dominated

by candidiasis and tuberculosis (Arifputra et al., 2014).

Pradipta et al.'s (2020) research proves that the clinical stage of HIV has a significant relationship with the incidence of opportunistic bacterial infections, namely tuberculosis (TB). However, factors such as age, gender, CD4+ T cell levels, viral load, history of blood transfusion and injecting drug use, as well as the history of education, work, and sexual behavior, have no significant relationship with the incidence of opportunistic TB infections. Thus, it can be said that the clinical stage of HIV is one of the determinants of the incidence of opportunistic tuberculosis infections in PLWHA.

Based on data from the Banten Provincial Health Office (2023), the accumulation of HIV/AIDS case findings in Banten Province has exceeded the national estimate because it amounted to 17,243 people or 103% with a reported death rate of 1,513 people in the period 1998–2023. Referring to these figures, it is known that cumulatively, PLWHA, who are still alive in Banten Province, are 15,730 people or 93% of the total cases. Based on the systematic review that has been conducted, it is known that the high number of case findings and the number of deaths that occurred in PLWHA in Banten Province have never been studied until now. Therefore, this study aims to determine the

relationship between the clinical stage of HIV according to WHO and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Methods

This research is a retrospective study with a cross-sectional design that will simultaneously analyze the relationship between two variables. This study was conducted from October 2024 to February 2025 at Banten Regional Hospital.

The target population in this study was HIV/AIDS patients in Banten Province, but the accessible population was HIV/AIDS patients who checked themselves and received treatment at Banten Regional Hospital. The sample of this study was HIV/AIDS patients at Banten Regional Hospital who had medical records from January 2020 to December 2024 who met the selection criteria in the form of inclusion and exclusion criteria.

This study uses a consecutive sampling technique. According to Tjoanda and Halim (2021), the consecutive sampling technique tends to control selection bias compared to other non-probability sampling methods, considering that the samples selected in this sampling technique are determined based on the subjects' characteristics. This sampling method is quite popular in clinical

trials or other hospital research (hospital-based research).

The sample size was determined based on calculations using the Lemeshow (1997) formula to test the difference between two proportions. Based on the sample size calculation, the minimum sample size required was 78 medical records of HIV/AIDS patients.

Data management is carried out through the stages of collection, verification, editing, coding, data entry, and cleaning according to the variables. The data is then processed using the SPSS 26.0 Program. The data were analyzed using univariate and bivariate, and the results will be displayed in the form of frequency and percentage tables.

This research involves human subjects and requires ethical review from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Sultan Ageng Tirtayasa University. A letter of ethical clearance has been issued for this research, number 2/UN43.20/KEPK/2025, to ensure the safety, anonymity, and confidentiality of research subjects.

Results and Discussion

Banten Regional Hospital Profile

Banten Regional Hospital is located at Jalan Syekh Nawawi Al-Bantani, Banjarsari Village, Cipocok Jaya District, Serang City, Banten Province. This hospital

is a type B referral-level health facility that has various types of health services, such as general and emergency medical services, specialist and subspecialist medical services, specialist medical support services, dental and oral specialist services, nursing and obstetric services, and clinical also non-clinical support services. This hospital provides every health service organized by integrated work units/service units (Banten Regional Hospital, 2022).

In order to provide health services to HIV/AIDS patients, there is a VCT (Voluntary Counseling and Testing) Clinic called the Aglonema Clinic, which provides counseling and testing services (blood tests). At this clinic, patients will be given education related to HIV, how it is transmitted, how to prevent it, and how to treat sufferers. Experienced and skilled counselors will also give patients

counseling services. The general purpose of this counseling is to dig deeper into the history of transmission, risk factors for transmission, follow-up treatment, and provide motivation and full support to sufferers to live a healthier lifestyle so that they are more productive. One of the active roles of the Aglaonema Clinic in efforts to break the chain of HIV transmission is to provide antiretroviral therapy (ARV) services (Banten Regional Hospital, 2022).

Distribution of Subject Characteristics

After going through the data management process such as tabulation, verification, editing, coding, data entry, and cleaning, the number of research samples that met the inclusion and exclusion criteria was 242 patients. The following table is the distribution of the characteristics subjects of this study.

Table 1. Characteristics of HIV/AIDS patients at Banten Regional Hospital in 2020-2024

Characteristics	Frequency	
	N	%
1. Age Based on Risk Factors		
≤ 14 years	6	2.48
15-24 years	24	9.92
25-44 years	170	70.25
45-54 years	24	9.92
≥ 55 years	18	7.44
2. Age Based on diagnostic criteria		
≤ 14 years	6	2.48
> 14 years	236	97.52
3. Gender		

Men	180	74.38
Women	62	25.62
4. Non-infectious comorbidities		
Have comorbidities	36	14.88
Have no comorbidities	206	85.12
5. The region of origin		
Serang city	50	20.66
Serang Regency	85	35.12
Pandeglang Regency	43	17.77
Lebak Regency	14	5.79
Cilegon City	8	3.31
Tangerang Regency	15	6.20
Tangerang City	4	1.65
Outside Banten Province	23	9.50

Based on Table 1 above, it is known that HIV/AIDS patients at Banten Regional Hospital are mostly aged 25-44 years (70.25%). According to gender, men are more likely (74.38%) to suffer from HIV/AIDS than women (25.62%). Regarding comorbidity or accompanying disease conditions, only 14.88% of patients have non-infectious comorbidities such as malignancies (lymphoma, hemangioma, lymphangioma, and others), nephrotic syndrome, kidney stones, ureteral stones, chronic kidney failure, heart failure, diabetes melitus, iron deficiency anemia, hepatomegaly, splenomegaly, LBP, thyrotoxicosis, dyspepsia, ulcerative colitis, hemorrhoids, anal fistula, and epilepsy. Based on the region of origin, mostly come from Serang Regency (35.12%), Serang

City (20.66%), and Pandeglang Regency (17.77%).

Age is one of the factors related to the incidence of HIV/AIDS and opportunistic infections (Yuliyanasari, 2017; Amelia, 2016). In this study, age grouping is divided into age based on risk factors and age based on diagnostic criteria. The results of the data analysis showed that HIV/AIDS patients at Banten Regional Hospital were dominated by the productive age group 25-44 years, with 170 patients (70.25%). In comparison, the age group with the least (rare) HIV/AIDS was children aged ≤ 14 years with six patients (2.48%). The age group of adolescents and young adults (15-24 years) and retirement age (≥ 55 years) each showed a frequency of 24 patients (9.92%) and 18 patients (7.44%). The results of this study are in line with the Executive Report

on the Development of HIV/AIDS and Sexually Transmitted Infections (STIs) in Semester I of 2024 by the Ministry of Health, which revealed that the percentage of PLHIV in the January-June 2024 period mostly came from the productive age group of 25-49 years (63%), followed by the young adult age group of 20-24 years (19%), and the retirement age group ≥ 50 years (10%).

According to Arvinda (2024), HIV infections tend to increase and mainly occur in the productive age group because someone aged 30-39 years is assumed to have a financially stable job so that they can meet primary and tertiary needs such as a lifestyle that is at risk of HIV infection, while those in their 20s tend to be less aware of the risk of HIV/AIDS transmission from a free lifestyle so that they easily fall into unsafe risky sexual behavior and drug use with non-sterile needles.

As stated in the research of Ratha and Indrawan (2019), the large number of infections that occur at a young age is often associated with a lack of emotional maturity and attitudes that correlate with a lifestyle of free sex and drug abuse. The pathophysiology of HIV infection takes 5-10 years to develop into AIDS, so patients aged 30-39 years have likely been infected with HIV since they were in their late teens or early adulthood.

Gender is one of the patient identities that is often associated with the incidence of HIV/AIDS and opportunistic infections. Based on the results of the data analysis that has been carried out, it is known that male patients dominate people living with HIV/AIDS at Banten Regional Hospital at 74.38%, while the other 25.62% are female. This result is in line with the Executive Report on the Development of HIV/AIDS and STIs Semester I of 2024 by the Ministry of Health, that the percentage of PLHIV found in men is 71%, while in women it is 29%.

As stated in the study by Framasari et al. (2020), in 2012, an estimated 350,000 people in the Asia-Pacific region were infected with HIV, 64% of whom were men. Another study by Sutini et al. (2022) in East Java also revealed that the majority of AIDS patients were male (70.74%), included in the adult group (26–45 years) (62.65%), and worked as employees/laborers (46.08%).

Regarding the incidence of opportunistic infections, this study was dominated by men as many as 84 out of 110 patients (76.36%), while women were only 26 patients (23.64%). This result is similar to the study by Ratha and Indrawan (2019), which stated that the distribution of the proportion of AIDS patients by gender was higher in men (55.60%) than in women (44.40%). This finding is similar to the Ministry of Health Report (2017), which

stated that the proportion of men infected with HIV was twice of women. Research by Yusri et al. (2012) at RSUP H. Adam Malik Medan also supported this finding, observing that of the 163 patients infected through sexual transmission, 73% were male. The dominance of AIDS cases by male patients is often associated with a high-risk lifestyle, more likely to have many sexual partners, and a tendency to use drugs (Ratha and Indrawan, 2019). However, some studies do not find significant differences between male and female patients. The study by Damtie et al. (2013) showed a comparable prevalence of opportunistic infections among men (21.5%) and women (18.5%). The results of a cross-sectional study by Damtie et al. in Ethiopia, which had different results from the study in Indonesia, were influenced by the demographics of the research subjects, which women dominated compared to men, namely 216 of the 360 patients (60%) studied were women.

Comorbidity is one of the factors that has the potential to increase the risk of HIV infection and opportunistic infections in PLWHA because it is considered capable of significantly suppressing the immune system's function (Yuliyanasari, 2017). Comorbidities can be infectious or non-infectious diseases. Based on the results of the data analysis that has been carried out, it is known that most HIV/AIDS patients at

Banten Regional Hospital do not have non-infectious comorbidities (85.12%), and only a tiny number of patients have non-infectious comorbidities (14.88%). In this study, infectious comorbidities will be further explained as opportunistic infections. Infectious and non-infectious comorbidities generally influence each other because they are related to the mechanism of immunosuppression. This result is in line with the research of Sutini et al. (2022), which states that opportunistic infections occur due to immune suppression and are believed to be responsible for the development of patient morbidity and mortality. This statement is also supported by Woldegeorgis et al. (2023), that opportunistic infections remain the primary driver of morbidity and mortality in HIV/AIDS patients, causing much higher mortality observed in low and middle income countries.

When viewed from the region of origin, HIV/AIDS patients at Banten Regional Hospital mostly come from Serang Regency (35.12%), Serang City (20.66%), and Pandeglang Regency (17.77%). Based on the Cumulative Case Report of AIDS in Banten Province, which is included in the Banten Health Profile for 2023, it is stated that the number of new PLHIV receiving treatment in 2023 is 1,251 cases. The most cases are in South Tangerang City, Tangerang City, Serang Regency,

Tangerang Regency, Lebak Regency, Pandeglang Regency, Serang City, and the least is in Cilegon City. The variation of cases in Banten Regional Hospital, which tends to be dominated by patients from Serang Regency, Serang City, and Pandeglang Regency, occurs due to the geographical location and ease of access to Banten Regional Hospital as well as the status as an advanced referral hospital from these areas (Banten Provincial Health Service, 2023).

Univariate Analysis

HIV/AIDS Incidence in Outpatients and Inpatients

HIV/AIDS cases at Banten Regional Hospital are most often diagnosed in outpatient and inpatient services. Therefore, the prevalence of HIV/AIDS was analyzed univariately by comparing the accumulation of HIV-positive patients with the total number of patients undergoing outpatient and inpatient treatment at Banten Regional Hospital in 2020-2024.

Table 2. Prevalence of HIV/AIDS at Banten Regional Hospital for the Period January 2020 - December 2024

HIV cases	Frequency	
	N	%
Positive	242	0.06
Not confirmed	422.976	99.94
Total	423.218	100

Based on Table 2 above, it is known that the prevalence of HIV/AIDS at Banten Regional Hospital in the last 5 years was 0.06%. This value is comparable to the Executive Report on the Development of HIV/AIDS Cases and STIs by the Ministry of Health, where the prevalence of HIV/AIDS in Indonesia in 2020 was 0.059%, in 2021 was 0.05%, and in 2022 was 0.069%. In line with this report, Putri et al. (2024) also revealed that the prevalence of HIV/AIDS in Jambi Province in 2020 was 0.017%, in 2021 was 0.018%, and in 2022 was 0.021%. As stated in the research of Sutini et al. (2022), in the Asian continent, except for Thailand and North India, most of the HIV infection rates in the general population are <1%.

HIV/AIDS Proportion Based on Clinical Stage

The World Health Organization (WHO) has developed a system for grouping the severity of HIV/AIDS patients into four clinical stages. The system uses standard clinical parameters as the basis for medical decision-making for patients with HIV/AIDS that can be implemented simply by observing the patient's clinical condition, thus accommodating HIV testing in health facilities with limited or no access to laboratory testing.

HIV/AIDS cases can be classified according to the severity of clinical signs that appear in WHO clinical stages I to IV. More severe infections are considered to have a worse prognosis, and the severity depends on pathogen exposure, pathogen virulence, and immunological status (Sutini et al., 2022). In this study, clinical stages I and II are grouped as early stages, while clinical stages III and IV are grouped as advanced stages. This refers to the study of Weinberg and Kovarik (2010), that advanced HIV/AIDS disease is defined as HIV/AIDS clinical stage III or clinical stage IV or any clinical stage with a CD4+ T cell count <350 per mm^3 .

In areas with adequate resources, laboratory measurements such as CD4+ T cell counts and HIV viral load are commonly performed as diagnostic tools to determine the patient's level of immunosuppression and assess the rate of immune system damage. However, limited resources for testing the number of CD4+ T cell and HIV viral load in several places, including some areas in Banten Province, ultimately mean that doctors have to rely on clinical parameters when assessing patients.

In this study, the proportion of HIV/AIDS patients based on clinical stage was analyzed univariately by comparing the number of patients at each stage with the total number of HIV-positive patients in 2020-2024.

Table 3. Proportion of HIV/AIDS patients based on clinical stage

HIV Clinical Stage	Frequency	
	N	%
Stage I	123	50.83
Stage II	19	7.85
Stage III	64	26.45
Stage IV	36	14.88
Total	242	100

Based on Table 3 above, it is known that according to the clinical stage, HIV/AIDS patients at Banten Regional Hospital have the highest proportion of stage I (50.83%), followed by stage III (26.45%), then stage IV (14.88%), and the lowest proportion is stage II (7.85%). The results of this study are similar to the study by Damtie et al. (2013) because the majority of research subjects came from clinical stage I, while the fewest number of research subjects came from clinical stage IV.

Research conducted by Ratha and Indrawan (2019) showed different patient characteristics, where the most common clinical stage of HIV found in VCT BRSU Tabanan was actually at clinical stage III (57.1%), then clinical stage I (23.1%), and clinical stage II (11.1%). Clinical stage IV, as the highest HIV stage, was the least found (8.7%). The difference in the dominance of clinical stages that occurred between BRSU Tabanan Bali and Banten Regional Hospital is likely due to

differences in the level of awareness to avoid free sex and patient awareness to check themselves at the hospital. However, the main reason for the difference in characteristics is the conditions in the field, which shows that many HIV/AIDS patients at Banten Regional Hospital have just been diagnosed in pre-operative screening. Hence, the data listed in the patient's medical records still show clinical stage I.

According to Ratha and Indrawan (2019), clinical stages III and IV are more often found in hospitals because clinical symptoms have appeared, causing patients to visit a doctor, compared to clinical stage I, which is asymptomatic, or clinical stage II, which still has mild symptoms. The number of patients with clinical stage IV in this study was also not as many as patients with clinical stage III; this may be due to the progression of the disease in patients with clinical stage IV who had died before they had the chance to check themselves at the hospital. It is known that HIV/AIDS patients in the advanced stages are more likely to come to the doctor because various symptoms have appeared, so they decide to check themselves after an opportunistic infection occurs.

Occurrence of Opportunistic Infections in HIV/AIDS Patients

Opportunistic infections are the most common complications in HIV/AIDS

patients (Indonesian Ministry of Health, 2024). Therefore, the prevalence of opportunistic infections in HIV/AIDS patients was analyzed univariately by comparing the accumulation of patients suffering from opportunistic infections with the total number of patients confirmed positive for HIV/AIDS at Banten Regional Hospital in 2020-2024. The proportion of opportunistic infections based on the number of infections in each patient was also analyzed univariately, considering that each patient can have more than 1 type of opportunistic infection.

Table 4. Prevalence of opportunistic infections occurring in HIV/AIDS patients

Opportunistic Infections	Frequency	
	N	%
Yes	110	45.45
No	132	54.55
Total	242	100

Based on Table 4 above, from 242 patients confirmed positive for HIV, the prevalence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital was 45.45%.

Table 5. Proportion of opportunistic infections based on the number of infections in each HIV/AIDS patient

Number of Opportunistic Infections	Patient Frequency		Infections Frequency	
	N	%	N	%
1	90	81.82	90	63.83
2	13	11.82	26	18.44
≥ 3	7	6.36	25	17.73

Total	110	100	141	100
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Based on Table 5 above, 110 patients were identified as having opportunistic infections, with a total incidence of 141 infections. Patients who only had 1 type of opportunistic infection numbered 90 patients (81.82%), those with two types of opportunistic infections numbered 13 patients (11.82%), and with ≥ 3 types of opportunistic infections numbered seven patients (6.36%).

HIV/AIDS patients suffering from >1 type of opportunistic infection in this study were patients in advanced stages (clinical stages III and IV). This was proven by Mitiku et al. (2015), a study conducted in Debre Markos reported that patients with advanced stages (clinical stages III and IV) were more likely to develop opportunistic infections than patients with early stages (clinical stages I and II). In their study, Mitiku et al. reported that 185 opportunistic infections were successfully diagnosed in 172 patients, with 44.7% of patients suffering from single opportunistic infections, 3.1% having dual opportunistic infections, and 0.3% having triple opportunistic infections.

Some HIV/AIDS patients continue to suffer from opportunistic infections even though they have undergone antiretroviral therapy (ART) because the immunological and virological responses of each patient are different. This was stated by Thate et al.

(2023), that ART has increased the life expectancy of patients with HIV/AIDS because it can suppress the virus while increasing the number of CD4⁺ T cells. Some HIV/AIDS patients show inconsistent immuno-virological responses, such as viral load suppression. However, immunological failure still occurs, or vice versa: a good immunological response occurs, but virological failure occurs. Several studies have reported that HIV/AIDS patients who have an inconsistent immuno-virological response are considered to have a higher risk of developing AIDS and death (Thate et al., 2023). According to Woldegeorgis et al. (2023), although ART has been shown to stop damage to the immune system and prevent the development of HIV disease, studies show that opportunistic infections have not disappeared, either due to the disclosure of subclinical infections, drug toxicity and interactions, drug resistance, or high exposure to infectious agents.

Types of Opportunistic Infections in HIV/AIDS Patients

Various infectious agents, such as viruses, parasites, bacteria, and fungi, can cause opportunistic infections. In this study, the proportion of types of opportunistic infections in HIV/AIDS patients was analyzed univariately by comparing the number of patients based on the etiology of infection with the total number of

opportunistic infections experienced by HIV/AIDS patients at Banten Regional Hospital in 2020-2024.

Table 6. Proportion of opportunistic infections based on etiology

Types of Opportunistic Infections	Frequency	
	N	%
Virus	9	6.38
Parasite	19	13.48
Bacteria	104	73.76
Fungi	9	6.38
Total	141	100

Based on Table 6 above, it is known that according to its etiology, the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital showed the highest proportion of bacterial infections (73.76%), followed by parasitic infections (13.48%), and the lowest proportion with the same value was fungal and viral infections (6.38%).

Accumulated, the most common opportunistic infections suffered by HIV/AIDS patients at Banten Regional Hospital are tuberculosis (44.68%) and toxoplasmosis (9.93%). Based on the etiology, opportunistic viral infections that found are bronchitis, hepatitis B, herpes zoster, and other infections. Then, opportunistic parasitic infections other than toxoplasmosis are cryptosporidiosis and other parasitic infections. Then, opportunistic bacterial infections other than

tuberculosis are impetiginization of dermatosis, impetigo, syphilis, otitis media, gonorrhea, other dominant sexually transmitted infections, and other bacterial infections. The opportunistic fungal infections are oral candidiasis, cutaneous mucormycosis, seborrheic dermatitis, histoplasmosis, tinea corporis, cryptococcal meningitis, and other fungal infections.

These results are in line with the research of Lubis (2011) in Ratha and Indrawan (2019) that the most common opportunistic infections in AIDS patients at RSPI Sulianti Saroso were tuberculosis (67.4%). The second most common was toxoplasmosis (22.8%), then candidiasis (5.4%), chronic diarrhea (3.3%), and hepatitis C (1.1%). In contrast to the research results at Banten Regional Hospital and RSPI Sulianti Saroso, the pattern of opportunistic infections that occurred at Airlangga University Hospital was dominated by oral candidiasis (58.6%), followed by pulmonary tuberculosis (41.4%) and pneumonia (41.4%) (Asmarawati, 2018).

In the research of Mitiku et al. (2015), the most common opportunistic infections in HIV patients in Ethiopia are oropharyngeal candidiasis and tuberculosis, followed by central nervous system (CNS) disease, sepsis, *Pneumocystis carinii* pneumonia, bacterial pneumonia, Kaposi's sarcoma, and lymphoma. In general, milder infections such as herpes zoster and other skin

infections occur in the early stages (clinical stages I and II), while serious life-threatening infections such as CNS toxoplasmosis and cryptococcal meningitis occur in the advanced stages (clinical stages III and IV). Some life-threatening infections, such as pneumonia and tuberculosis, can occur in both the early and late stages.

Mycobacterium tuberculosis is a significant cause of morbidity and mortality among people living with HIV worldwide. In countries with a double burden of TB and HIV, the risk of developing tuberculosis in HIV/AIDS patients can be as high as 29-fold. According to WHO, in 2013, tuberculosis was the leading cause of death among people living with HIV (PLHIV).

The main factor behind the death of HIV patients with tuberculosis and vice versa is late diagnosis. The risk of tuberculosis is estimated to be 16–27 times greater in PLHIV compared to those without HIV infection. Meanwhile, autopsy studies among people who died of AIDS showed that almost half (46%) of them had

undetected TB before death (Indonesian Ministry of Health, 2020).

Looking at previous studies, opportunistic infections found at Banten Regional Hospital showed a different pattern of infection types compared to other hospitals. This proves there are differences in opportunistic infections between health centers because the pathogen patterns differ (Ratha and Indrawan, 2019). In addition, the role of Banten Regional Hospital as a referral center also contributes to the diversity of opportunistic infections because the demographics of its patients come from various cities/regencies.

Bivariate Analysis

This study was also analyzed bivariate to determine the relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital from January 2020 to December 2024 through the Chi-square statistical test. This study also assessed the odds ratio (OR) using the Mantel-Haenszel Common Odds Ratio Estimate in the SPSS 26.0 Program.

Table 7. Chi Square Test and Mantel-Haenszel Common Odds Ratio Estimate Test

Clinical Stage HIV	Opportunistic Infections				Total (n)	p-value	OR (95% CI)
	Yes		No				
	N	%	N	%			
Advanced Stage (Stage 3-4)	91	37.60	9	3.72	100	0.000 ^a	65.46 (28.31-151.34) ^b
Early Stage (Stage 1-2)	19	7.85	123	50.83	142		
Total	110	45.45	132	54.55	242		

Note: a) Chi Square Test and b) Mantel-Haenszel Common Odds Ratio Estimate

Based on Table 7 above, it is known that the results of the Chi-Square test analysis show a p-value of 0.000, considered significant because $p < 0.05$, which means that the hypothesis is accepted, that there is a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital. These results are in line with the research of Dereje et al. (2019), which stated that there was a statistically significant difference in the incidence of opportunistic infections between WHO clinical stages, where the incidence of opportunistic infections was higher in stages III and IV compared to stages I and II with a p-value < 0.01 .

WHO clinical stage is the most significant predictor of opportunistic infections, according to Dereje et al. (2019). Patients infected with HIV in stages III and IV are more likely to develop opportunistic infections than patients in stages I and II. The most likely explanation for this is the

tendency of high viral load with low CD4+ T cells counts in HIV/AIDS patients in stages III or IV. A study in Nigeria showed that viral load and CD4+ T cells counts are major risk factors for opportunistic infections in HIV/AIDS patients.

The odds ratio (OR) analyzed using the Mantel-Haenszel Common Odds Ratio Estimate test in the table above shows a value of > 1 , namely 65.46 (95% CI; 28.31-151.34), which means that HIV/AIDS patients in advanced stages (clinical stages III-IV) have a risk of opportunistic infections 65.46 times greater than HIV/AIDS patients in early stages (clinical stages I-II). The common odds ratio lower bound and upper bound values show the upper and lower limits of the odds ratio, that advanced-stage HIV/AIDS patients have the slightest risk of 28.31 times and the most significant risk of 151.34 times experiencing opportunistic infections compared to early stage HIV/AIDS patients. The results of this analysis are in

line with the research of Mitiku et al. (2015), which revealed that patients in clinical stage IV are about four times (AOR = 3.856; 95% CI = 2.691-10.390) and patients in clinical stage III are about three times (AOR = 2.801, 95% CI = 1.958-7.165) more at risk of developing opportunistic infections compared to patients in stages I and II.

The immunological status of HIV/AIDS patients is generally assessed using a CD4+ T cells count. However, if this test is unavailable, the immunological status can be assessed by examining the patient's clinical signs, which are then grouped based on their clinical stage. According to Edathodu et al in Viyani and Kurniasari's (2025) study, it was stated that HIV patients in clinical stage I have a higher number of CD4+ T cells, while HIV/AIDS patients in stage IV have a lower number of CD4+ T cells. Advanced-stage HIV/AIDS patients have also been reported to tend to the number of CD4+ T cells to be 7 times lower than patients in the early stages (Melku et al., 2020). A low number of CD4+ T cells is known to increase the susceptibility to opportunistic infections as well as an increase in the clinical stage of HIV. The study by Viyani and Kurniasari (2025) concluded that there was a significant relationship between the number of CD4+ T cells and the clinical stage of HIV ($p < 0.001$). The number of CD4+ T cells

< 200 cells/mm³ is most often found in advanced-stage HIV/AIDS patients (clinical stages III and IV), while the number of CD4+ T lymphocytes > 500 cells/mm³ is generally found in early stage HIV patients.

Determining the clinical stage of HIV plays an essential role in the management of HIV patients, including the timing of initiation of therapy, changes in the type of therapy, administration of prophylactic therapy, and other interventions. Antiretroviral therapy (ARV) is the primary pharmacological therapy given to HIV/AIDS patients. Based on WHO recommendations, ARV therapy must be given to all patients who are confirmed positive for HIV regardless of the clinical stage or the number of CD4+ T cells they have. ARV therapy is reported to increase life expectancy and reduce the risk of opportunistic infections (Viyani and Kurniasari, 2025).

According to Melku et al. (2020), factors such as poor adherence to ARV therapy, immune status in the form of low initial CD4+ T cell count, low body mass index (underweight), advanced HIV stage, and short duration of ARV treatment can negatively impact immunological status and virologic suppression, resulting in failure of targeted treatment in HIV/AIDS patients.

Conclusion

The prevalence of HIV/AIDS at Banten Regional Hospital in 2020-2024 was 0.06%, with the highest proportion being stage I and stage III of all confirmed HIV/AIDS patients. The prevalence of opportunistic infections was 45.45%, with a total incidence of opportunistic infections is 141 types of infections. Opportunistic bacterial infections and opportunistic parasitic infections dominated the proportion of opportunistic infections based on etiology. The most common opportunistic infection was tuberculosis, and the second most common was toxoplasmosis. There was a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Further research, including multicenter studies and the use of primary data sources (directly examining HIV/AIDS patients), is needed to produce more representative epidemiological data. The relevant government is also expected to support and facilitate hospitals in conducting better laboratory tests to definitively diagnose opportunistic infections, thus providing more adequate therapy. Furthermore, mass screening of populations at risk of HIV transmission in Banten Province is needed to reduce the prevalence of AIDS and

contribute to the government's HIV/AIDS response program in Indonesia.

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